a buzz planer, twenty work benches, with full set of lathes and carpenters' tools required for instruction. A brick building with two large rooms has been constructed specially for instruction in working iron. One of these is equipped with twelve forges, and tools necessary for a forge department; the other with a cupola furnace, moulding benches, and special tools for use in a foundry. The machine is equipped with eight engine lathes with appropriate tools, and a chipping and filing department is arranged, with benches and vices for twelve students. A five horse-power dynamo furnishes light to the mechanic, art laboratory, and other halls, and it is designed to supply the different laboratories with electricity from this source.

Although there are these signs of enterprise, and although the public school system of the State includes elementary schools, high schools for girls, and normal colleges for teachers, Alabama proves, when its educational statistics are examined, to be one of the most backward States in the Union. The latest returns of the United States Commissioner show that the public schools are open on an average only 79 days in the year, and that the average attendance is only 63 per cent. of the number enrolled. The sum annually expended on education is not large, and amounts only to an average of 4 dollars 17 cents per head on the number of scholars. Of the total school revenue, 20 per cent, is derived from land and real estate, 55 per cent. from State taxation, and 24 per cent. from poll taxes, licenses, and other local imposts. Special provision was made in 1867 establishing separate schools for coloured children, who are numerous and increasing in number in this as in most of the Southern States. The last returns show a total of 212,821 coloured children of school age, of whom 98,919 are enrolled in the public schools set apart for them, while 66,424 are on an average in daily attendance during the school year. The year, however, is one of 67 days only. The average cost to the State of the coloured pupils is 2 dollars 10 cents.

These particulars sufficiently indicate the very exceptional conditions under which education is carried on in one of the most important of the South Central States of America, and will show to any student of the subject how much of interesting material has been accumulated in Mr. Clark's well arranged and well illustrated book.

CHEMISTRY FOR BEGINNERS.

Elementary Systematic Chemistry for the Use of Schools and Colleges. By William Ramsay, Ph.D., F.R.S. (London: J. and A. Churchill, 1891.)

AMONG the large number of text-books of elementary chemistry written for the use of schools, this volume will take its place with the very few that are not specially designed to prepare the student for some examination. It is further to be distinguished as having the classification and order of treatment of the elements based upon their periodic arrangement. The author deserves the thanks of those interested in the matter for making this experiment, whether the result be regarded as successful or otherwise. He states in the preface that he hopes "that the method of treating the subject of chemistry adopted in this short sketch may help to demonstrate the value of its study as a training in classification, and as a means of developing the reasoning powers." Certainly this is desirable, and the volume tends in this direction. We find, for example, the preparation of the elements treated under such headings as "Electrolysis of a Compound," "Decomposition of a Compound by Heat," &c., and there is much advantage in comparing the processes that serve for the isolation of the elements in this manner. But the first aim of a knowledge of chemistry is not to develop the reasoning powers. It is rather to give the student more exact ideas than he would otherwise have of the constitution and properties of matter, and it is important to get into his mind not simply the relationships that substances bear to one another, but a definite idea of each substance and its properties. We think that an inspection of the volume before us will confirm the experience of the past that an elementary text-book does well to aim, above all things, at presenting a distinct, and, as far as may be, complete description of each substance, leaving the classification of methods and reactions to the judgment of the teacher or the ingenuity of the student when it is impossible to include both aspects of the matter. Taking oxygen as an example, we are in the habit of finding a chapter in which the methods that serve for its preparation, and its more important properties are set forth in a connected and convenient manner. But in this volume the directions for the preparation of oxygen occupy a few paragraphs in a chapter entitled "Decomposition of a Compound by Heat," at p. 73, while the properties of oxygen are not described till we get to p. 93. To say the least of it, it would be very inconvenient for a student, after having prepared his oxygen, to busy himself with the preparation of sulphur from pyrites, the preparation of magnesium, aluminium, boron, silicon, hydrogen, several metals, the properties of hydrogen and about seventeen metals, besides boron, carbon, nitrogen, phosphorus, and arsenic, before he comes to a practical investigation of the properties of his oxygen.

The author has endeavoured to treat first of the elements, and subsequently of compounds. But elements and compounds are interdependent, and it is obvious that such a separation is practically impossible. We think it is unwise to attempt it, unless, indeed, chemistry is to be degraded into a mere "means of developing the reasoning powers." If education is for this purpose only, the student of a foreign language would do well to devote himself entirely to its grammar, and leave the vocabulary for those who desire knowledge for its own sake.

The difficulty of finding a good beginning place in the teaching of any science has been obvious to all those who have undertaken the task. If children are to be taught, they must be led by slow degrees from what they know to an expanded and fuller knowledge of the matters they are already acquainted with, and so onwards. The periodic law is beyond the grasp of a young student, and the only valid reason that should allow his course of work to be guided by it would be that the subject was thereby rendered more agreeable or more intelligible to him. It does not appear that the periodic law will be able to fulfil this new function.

Looking at the book more in detail, we notice that 60 pages are devoted to chemical physics, 144 pages to

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inorganic chemistry, and 141 to organic chemistry. The student who is already fairly acquainted with the subject will find the summaries of properties, &c., of much use. The analogous compounds of various groups of elements are treated together, and their differences are concisely remarked upon. He will, perhaps, be a little troubled at first to find names employed in an unusual manner. For instance, Ag_2O is called argentous oxide; AgO, argentic oxide; AgCl, AgBr, silver chloride, &c.; and there is a statement that "no *argentic* halides are known." If he looks up the paragraph on valency, he will find silver put down as a monad along with hydrogen, potassium, &c., and not with copper and mercury, which are marked monad and dyad. There are other inconsistencies that might have been eliminated, such as in the use of the words distill, and sublime. Directions are given to distill a fluoride with strong sulphuric acid, to distill a mixture of sand, fluor-spar, and sulphuric acid, and so on, and on turning to the description of the operation of distillation, in the first part of the book, we find that the word is used there in its correct sense. The solution of a carbonate in an acid is spoken of, and the sublimation of a mixture of mercuric sulphate and salt. Such operations are impossible according to the meaning of the words expressing them given in the earlier part of the work. The statement that chlorine peroxide is formed by distilling a chlorate with sulphuric acid at a low temperature might lead to serious accidents in the case of the young students for whom the volume is primarily intended. While the symbol Aq. is used to represent the water of solution, a refinement which is scarcely necessary in an elementary treatise, the reaction taking place when a jar of chlorine is inverted over a strong solution of ammonia is represented by an equation that demonstrates the liberation of hydrochloric acid. It is such inconsistencies as these that perplex and mislead the student.

C. J.

OUR BOOK SHELF.

Applied Geography. By J. Scott Keltie. (London: George Philip and Son, 1890.)

THE greater part of this volume consists of four lectures which were delivered last year at the Bankers' Institute, and given in part before the Society of Arts and the College of Preceptors. An article which appeared originally in the *Contemporary Review* is also included. The volume is one of great interest, both theoretical and practical, and ought to be of genuine service to various classes of readers, by showing how high is the place which must properly belong to geography in any complete scheme of education. Mr. Keltie has been especially successful in indicating some of the influences which geographical facts have exerted on the movements of races and the evolution of nations. On so great a subject it was impossible for him, within narrow limits, to develop any of his ideas fully; but his suggestions are excellent, and may perhaps be worked out by some of his readers for themselves. Mr. Keltie has much to say about the bearings of geographical conditions on the development of Africa, and about the relation of geography to the commercial prosperity of the British Empire. He also discusses various problems connected with the actual and possible geographical distribution of some of the common commodities of commerce. On all these subjects he writes with freshness and lucidity, displaying a thorough grasp of the principles of geographical science Maps and diagrams, for which the author expresses his thanks to Mr. Ravenstein, add considerably to the value of the text.

The Autobiography of the Earth. By the Rev. H. N. Hutchinson, B.A., F.G.S. Pp. 290. (London: Edward Stanford, 1890.)

WE have rarely met with a popular work on geology or natural history so crowded with information as Mr. Hutchinson's little volume now before us. In less than 300 pages of large type, all the leading features of the "geological record" are passed in review, with special reference to the mode of reasoning by which the various facts and inferences are established. Nothing of importance seems to be omitted, from the nebular hypothesis and the birth of the moon, to theories of glacial epochs, the permanence of ocean basins, the origin of oolitic structure, and the method of discovering the hidden appendages of trilobites. Some of the sections, indeed, such as those relating to the nebular theory and the nature of geological agents, are seldom found more concisely arranged even in the pages of an examination "cram-book."

With all this wealth of material, however, the author succeeds in completely divesting his work of the "dry" and "uninteresting" formality which, in his opinion, repels the general reader from ordinary text-books. The several chapters are pleasantly written and illustrated with occasional woodcuts; while, although the accounts of the successive formations are systematically arranged from the Archæan to the Pleistocene, every occasion that permits of some digression into general principles is turned to good advantage An allusion to the igneous rocks of the Devonian period thus leads to a few brief paragraphs on the interest of denuded volcanoes; the Lower Carboniferous rocks afford an opportunity for discussing the origin of limestones; the chapter on the Oolitic rocks is followed by another on the organization of Mesozoic reptiles; and the short notice of the Glacial period forms a fitting occasion for digressing to the subject of ice as a geological agent. If, in any respect, the general reader's interest fails, it will be due to the too frequent use of inadequately defined technical terms, and the too rapid succession of unfamiliar ideas. Of such terms as "schist" and "Neocomian," for example, the definition seems to have been quite overlooked.

In a compilation of so wide a scope it is, of course, easy for a specialist to detect inaccuracies, but the present volume bears evidence of so much care bestowed in its preparation, that absolute errors appear to be unusually few. The bold statement on an early page that glaciers erode valleys like rivers is qualified in the last chapter; and the assertion that no Chelonian bones have been found in the Trias is corrected in a footnote on a later page. The most serious error is the frequent quotation of brachiopods and polyzoa as Mollusca; and nearly all the lesser misstatements relate to biological matters. The author, however, unlike many popular writers, has been trained in the modern school, and thus recognizes throughout the broad principles of organic evolution.

The volume is well printed, and issued in a style uniform with Miss Arabella Buckley's popular works, to which it forms a worthy companion.

A. S. W.

Spinning Tops. "Romance of Science Series." By Prof. John Perry, F.R.S. (London: Society for Promoting Christian Knowledge, 1890.)

IN September last Prof. Perry delivered the "Operatives' Lecture" of the British Association meeting held at Leeds, the subject of which was entitled "Spinning Tops." The present little work is a revised and much expanded edition of that lecture, and, instead of the moving apparatus originally displayed, the author has provided a

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